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Notes:

1. Untranslatable words are replaced with asterisks (****).
2. Texts in the figures are not translated and shown as it is.

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FULL CONTENTS

[Claim(s)]

[Claim 1]A whole surface floor blow-off method air-conditioner which comprised a floor member which is allocated by the lower part of ** characterized by comprising the following, and has many air supply holes on the whole surface, an air supply chamber formed in the lower part of this floor member, an exhaust passage connected to the upper part of the aforementioned room, and an air conditioner connected to said air supply chamber.

A means to detect charge air temperature and the degree of ***** of said air conditioner.

A means to calculate temperature of an indoor habitation region from said charge air temperature and the degree of *****.

A means to control charge air temperature by temperature of said calculated habitation region.

[Claim 2]The temperature controller comprising according to claim 1:

A means to calculate temperature of the habitation region upper part and the lower part from said charge air temperature and the degree of *****.

While controlling temperature of the habitation region lower part by changing charge air temperature in the air conditioning mode of operation, A means to control by blowing off temperature of the habitation region upper part, and changing the amount of winds, and to control temperature of the habitation region lower part in the heating mode of operation by changing charge air temperature and quantity of the blow-off style.

[Claim 3]The temperature controller according to claim 2 acquiring an output value of charge air temperature and quantity of the blow-off style by making fuzzy said calculated temperature with a membership function, and performing fuzzy reasoning based on a fuzzy rule.

[Detailed Description of the Invention]

[0001]

[Industrial Application]This invention relates to the temperature controller in the whole surface floor blow-off method air-conditioner which puts the coldness-and-warmth wind on the flow of natural air indoors, and performs efficient comfortable air-conditioning while sending gently and uniformly the

coldness-and-warmth wind for air-conditioning into the interior of a room from the whole floor surface.
[0002]

[Description of the Prior Art] The problem of the uneven temperature distribution by generation of heat from temperature distribution local in air-conditioning in recent years or omnipresent OA equipment near the blow-off mouth of an office building, etc., Winding up has been SUBJECT with ***** ticks, and important molding, or solving the problem of contaminants, such as cigarette smoke, body odor, and expiration, etc., and realizing clean and comfortable air-conditioning environment from the floor which. [of the air current by existence of a partition, furniture, etc.] [of disorder] [the problem, and] [the floor, especially]

[0003] However, even if it makes the conventional general air-conditioning method into a ceiling blow-off method and makes it into a floor blow-off method, it is a perfect mixing type method which agitates indoor air positively under the influence of air supply from a blow-off mouth.

In order for air supply to perform dilution and diffusion for the contaminant accompanied by the heat which occurred or flowed indoors, it is difficult to remove a contaminant completely.

If an air change rate is made to increase to removing a contaminant to some extent, it is possible, but. In order to maintain the room temperature considered as a request, quantity of the blow-off style must be increased, or in air conditioning of charge air temperature, it is quite low, and, in heating, must be made quite high, and enlargement of equipment and the increase in energy expenditure are caused.

[0004] In JP,H6-229584,A in order to solve this problem, [these people] From the air-conditioning unit, it exhausted so that the staining material accompanied by the heat which supplied air indoors, and occurred or flowed it indoors from the air supply hole of the floor member might be turned to an exhaust passage and might be pushed out from the exhaust air hole of a ceiling member through an air supply passage, and the air-conditioning method which wrapped the resident in always new air supply was proposed.

[0005]

[Problem to be solved by the invention] Drawing 3 shows the experimental result which this invention person performed in the above-mentioned air-conditioning method, and shows the temperature distribution of the indoor height direction at the time of making heat load increase to A-F. According to this, it became clear that the difference in temperature of a resident's upper part and the lower part became large as heat load increased. Thus, while it has the advantage that a contaminant is removable, in the above-mentioned air-conditioning method, by the upper and lower sides of a room, since air supply flows towards a ceiling at a low speed from a floor, a temperature gradient occurs, and, [a resident] For example, if displeasure may be given to environment with distribution, or the displeasure that an ankle is cold may be felt and it is going to control charge air temperature to indoor preset temperature, it has the problem of consuming useless energy.

[0006] In order to solve this problem, these people have proposed a method which controls charge air temperature from an air conditioner by air temperature of the habitation region lower part and with which they control quantity of the air supply style from an air conditioner by air temperature of the habitation region upper part in Tokuganhei6-22466. However, although it is necessary to provide a temperature sensor in a habitation region in this method, in fact, it interferes with arrangement of a partition or various OA equipment, popularity is won on a design again in many cases, and selection of an attaching position of a temperature sensor has the problem that it is difficult in many cases.

[0007] The purpose of this invention is as follows.

Send gently and uniformly a coldness-and-warmth wind for air-conditioning into the interior of a room from the whole floor surface.

In a whole surface floor blow-off method air-conditioner which puts the coldness-and-warmth wind on a flow of natural air indoors, and performs efficient comfortable air-conditioning, While making temperature of a habitation region controllable and realizing clean and comfortable air-conditioning environment, without providing a temperature sensor indoors, provide a temperature controller which can raise energy-saving nature.

[0008]

[Means for solving problem]Therefore, a floor member which this invention is allocated by the lower part of ** and has many air supply holes on the whole surface, A whole surface floor blow-off method air-conditioner which comprised an air supply chamber formed in the lower part of this floor member, an exhaust passage connected to the upper part of the aforementioned room, and an air conditioner connected to said air supply chamber is characterized by comprising:

A means to detect charge air temperature and the degree of ***** of said air conditioner.

A means to calculate temperature of an indoor habitation region from said charge air temperature and the degree of *****.

A means to control charge air temperature by temperature of said calculated habitation region.

[0009]

[Function and Effect(s) of the Invention]In this invention, while making temperature of a habitation region controllable and realizing clean and comfortable air-conditioning environment, without providing a temperature sensor indoors by calculating the temperature of an indoor habitation region from charge air temperature and the degree of ******, energy-saving nature can be raised.

[0010]And the air which passed to punctiform via the blow-off hole of a floor member serves as uniform blow off from the whole floor surface to the interior of a room, an excessive feeling of an air current of it is lost, and it is comfortable and can realize air-conditioning without spatial deviation. The heat rise style which originates in the generation of heat in the upper part of heating elements, such as a human body and OA equipment, has arisen, The air to which air was supplied is induced this flow, and gathers for a heating element, the contaminated air C containing contaminants, such as heat load and cigarette smoke, moves to upper space promptly, and the resident's M circumference will be in the state where it was always wrapped in the fresh air which oozed out from the whole floor surface. Since temperature stratification is formed indoors, a required air change rate can be reduced, and, as a result, reduction and a miniaturization of an air conditioner and the power of the fan for exhaust air can be attained, and the device heat load of an air conditioner can be reduced. This can be perceived right above a fire source and early perception of a fire can be performed. The air supply can control breeding of ticks and mold by periodical aeration while the dust adhering to a floor does not soar and cleaning becomes easy by the breathability of a tile carpet, in order to ooze out to the interior of a room at super-fine wind velocity. Since air supply oozes out from the whole floor surface, the layout of OA equipment or furniture can be designed freely, the air to which air was supplied even if it was a case where OA equipment was omnipresent can flow towards a heating element autonomously, and air-conditioning environment which is superficially uniform can be realized. Since it is not necessary to install a duct in the air supply side and an exhaust side and air can be supplied also by a low floor, it has the effect that construction cost

can be reduced.

[0011]

[Working example]Hereafter, the embodiment of this invention is described, referring to Drawings. Drawing 1 is a lineblock diagram showing one embodiment of the temperature controller in the whole surface floor blow-off method air-conditioner of this invention.

[0012]In drawing 1, ** 1 is formed between the up-and-down slab 3 and 4. The floor member 5 which has many blow-off holes 5a is formed in the whole surface at the lower part of ** 1, and the double floor is constituted. The air supply chamber 6 is formed in the inside of a double floor, i.e., the lower part of the floor member 5. At about 10 mm, as for the diameter of the blow-off hole 5a, the sum total of the area of the blow-off hole 5a needs to secure not less than 1.5% of the area of the floor member 5 whole. It is because air resistance increases rapidly that it is less than 1.5% and extreme pressure loss arises. Since it blows off like the conventional floor blow-off air-conditioning and it is not necessary to embed a mouth at a floor, the height of a double floor is simply prescribed by only the circulation condition of air. Therefore, it becomes unnecessary to secure the height of the conventional OA floor 200-300 mm, and if it is the usual office, it can be said that about 100 mm is enough.

[0013]The ceiling member 7 which has two or more exhaust air holes 7a is allocated in the upper part of ** 1, and the exhaust air chamber 8 is formed in the upper part of the ceiling member 7. The exhaust air fan 9 is connected to the exhaust air chamber 8. Although two or more exhaust air holes 7a are formed in the ceiling member 7, [in this example] One thru/or two or more exhaust ports may be provided, and an exhaust port may be provided in the upper part of a wall, or an exhaust port may be prepared for the both sides of the ceiling member 7 and a wall, and in short, without providing a duct in the air supply side and an exhaust side, it constitutes so that air supply and exhaust to the interior of a room may be made. The carpet 10 of breathability is constructed all over the floor member 5.

[0014]The air conditioner 12 is allocated in the machinery room 11 which adjoined ** 1. The air conditioner 12 has the fan 13, the heat exchanger 14, the filter 15, the charge-air-temperature sensor 16, and the ***** degree sensor 17, While the discharge side of the fan 13 is connected to the air supply chamber 6, it is connected to the exhaust air chamber 8, and the suction side is constituted so that a part of exhaust air may be supplied to the air conditioner 12 through the machinery room 11. While the detection signal of the temperature sensors 16 and 17 is inputted into the control device 18, operation processing later mentioned in the control device 18 is performed and a charge-air-temperature signal is outputted to the heat exchanger 14, the quantity signal of the blow-off style is outputted to the fan 13. The heat exchanger 14 is used as a condenser or a warmer, and, in the case of a coldness-and-warmth water coil method, control of charge air temperature is control of a flow control valve.

In the case of a refrigerant pump system, it is control of a refrigerant flow.

[0015]The air supply speed in ** 1 supplies air so that it may ooze out into the sitting-room 1 at the super-fine wind velocity (speed which man's skin does not feel) of 0.1 mm/s - about (preferably 5 mm/s - 10 mm) 100 mm, and he is trying to form temperature stratification in the sitting-room 1 in this air-conditioning method. However, it is not avoided that a temperature gradient sticks by the upper and lower sides of ** 1 as the temperature distribution of the height direction in ** 1 is shown in drawing 3, but a state with the lower part of ** 1 clean at low temperature and the upper part of ** 1 will be in a state with many contaminants at high temperature comparatively.

[0016]The flow figure in which drawing 2 and drawing 3 show one embodiment of the temperature

controller in this invention, and drawing 2 shows the flow of processing of air-conditioning control, and drawing 3 are the figures showing the temperature distribution curve of the height direction of **.

[0017] First, the temperature TP of the height which carries out initial setting of the temperature TS of the height which has a habitation region at Step S1 to request temperature, inputs charge air temperature and the degree of ***** at Step S2, and has a habitation region from charge air temperature and the degree of ***** at Step S3 is calculated. This operation uses the temperature distribution curve shown in drawing 3. Drawing 3 shows the experimental result which this invention person performed, shows the temperature distribution of the indoor height direction at the time of making heat load increase to A-F, and is crooked in height (near 1000 mm) with a distribution curve, and the temperature gradient has a linear relation in the upper part and the lower part of a crooked point. Therefore, the temperature TP of the height which memorizes the relation shown in drawing 3 in the form of a map or a table, or has a habitation region from charge air temperature and the degree of ***** with a computing equation can be calculated. And charge air temperature is set up for it to be inversely proportional to the deviation (TP-TS) of the habitation region temperature TP and the initial-setting temperature TS which were calculated at Step S4, and a charge-air-temperature setup is outputted at Step S5. Quantity of the blow-off style is fixed in this example.

[0018] Drawing 4 and drawing 5 are the flow figures in which showing other embodiments of the temperature controller in this invention, and showing the flow of processing. TP_{+100} among a figure The temperature of the habitation region lower part (a height of a floor to 100 mm), The preset temperature of the habitation region lower part and TP_{+1700} TS_{+100} The temperature of the habitation region upper part (a height of a floor to 1700 mm), TS_{+1700} is shown and the preset temperature of the habitation region upper part, [the deviation (ΔT_{+100}) of habitation region lower temperature] The deviation (ΔT_{+1700}) of the preset temperature (TS_{+100}) of the temperature (TP_{+100})-habitation region lower part of the habitation region lower part and habitation region top temperature is the preset temperature (TS_{+1700}) of the temperature (TP_{+1700})-habitation region upper part of the habitation region upper part.

[0019] In the air conditioning mode of operation, [the fundamental view of the control in this example] In [control the temperature of the habitation region lower part (step part) by changing charge air temperature, control by blowing off the temperature of the habitation region upper part (head), and changing the amount of winds, and] the heating mode of operation, It is controlling the temperature of the habitation region lower part (step part) by changing charge air temperature and the quantity of the blow-off style. Therefore, first, as shown in drawing 4, charge air temperature, the temperature (TP_{+100}) of the degree of ***** to the habitation region lower part, and the temperature (TP_{+1700}) of the habitation region upper part are calculated. The arithmetic method is the same as that of said embodiment.

[0020] And as shown in drawing 5, initial setting of the preset temperature (TS_{+100}) of the habitation region lower part and the preset temperature (TS_{+1700}) of the habitation region upper part is first performed at Step S1, The habitation region lower temperature (TP_{+100}) and habitation region top temperature (TP_{+1700}) which were calculated by drawing 4 at Step S2 are inputted. Next, Step S3

compares preset value-alpha' beforehand set to the deviation (ΔT_{+100}) of habitation region lower temperature, When the deviation (ΔT_{+100}) of habitation region lower temperature is lower than preset value-alpha', the amount of winds and charge air temperature are adjusted in proportion to the deviation (ΔT_{+100}) of habitation region lower temperature by it until a temperature underfoot gets warm at the heating mode of operation of Steps S4-S7.

[0021]When habitation region lower temperature (TP_{+100}) gets warm ($\Delta T_{+100} > \text{-alpha}'$), Go into the air conditioning mode of operation of Steps S8-S11, and, [control of habitation region top temperature (TP_{+1700})] It is made to be proportional to the size of the deviation (ΔT_{+1700}) of habitation region top temperature, and the amount of winds is adjusted, and control of habitation region lower temperature (TP_{+100}) is proportioned in the size of the deviation (ΔT_{+100}) of habitation region lower temperature, and adjusts charge air temperature.

[0022]Drawing 6 - drawing 10 show other embodiments of the temperature controller in this invention. Drawing 6 is a lineblock diagram of a control system showing other embodiments of this invention. This example has applied the fuzzy theory which can program efficiently the control logic of the many inputs of drawing 5, and many outputs. The fuzzy control unit 21 comprises the input / operation part 22, the fuzzy-ized part 23, the fuzzy reasoning part 24, and the un-fuzzy-ized part 25.

[0023]The fuzzy-ized part 23 is a portion which performs delivery with the habitation region temperature calculated in input / operation part 22, and the ambiguous natural language which man has, like "it is "high", ["just right"], and low."

Each membership function is shown below and fuzzy-ization is explained to it.

[0024]Drawing 7 (A) shows a membership function of temperature (TP_{+100}) of the habitation region lower part, according to temperature inputted, is changed ["it is "low" and right just" and] into an ambiguous word "it is high" by the reliability mu of a grade of 0-1, and is made fuzzy. For example, to preset temperature TS_{+100} , by the reliability 1, TS_{+100} -alpha is changed into a word "it is low", and, [$TS_{+100} + \text{alpha}$] It is changed into a word "it is high" by the reliability 1, and T' is changed into a word "it is high" by about 0.3 reliability at about 0.7 reliability or a word "it is right just."

[0025]Drawing 7 (B) shows a membership function of a time rate of change in temperature (TP_{+100}) of the habitation region lower part, according to a rate of change, is changed into an ambiguous that it is "under [increase]" saying word by the reliability mu of a grade of 0-1 "during reduction", and is made fuzzy. Similarly, drawing 8 (A) shows a membership function of temperature (TP_{+1700}) of the habitation region upper part, and drawing 8 (B) shows a membership function of a rate of change in temperature (TP_{+1700}) of the habitation region upper part.

[0026]As mentioned above, since a membership function is subjectively decided by an operator's experience or intuition, [a setup of a membership function, and correction] An operator can carry out freely sensuously on CRT and man's ambiguous evaluation axis can be downloaded to a computer as it is. Therefore, conditions of a knowledge base can be described not by a numerical value but by ambiguous natural language, and a thing outstanding in respect of an interface with an operator can be

provided.

[0027] Next, in the fuzzy reasoning part 24, fuzzy reasoning is performed based on a fuzzy rule. If the amount of winds is increased when making an up-and-down difference in temperature change and controlling TP_{+1700} temperature by adjusting the amount of winds, If an up-and-down difference in temperature becomes small, therefore TP_{+1700} temperature becomes low and the amount of winds is decreased conversely, an up-and-down difference in temperature will become large, therefore TP_{+1700} temperature will become high. fuzzy-rule-izing based on this -- IF; temperature = -- high amount of THEN; winds = -- it is expressed in IF-THEN of making it quite large - form. That is, a state of the conditional part IF - a controlled object was described, and the contents of operation according to the state were described by Conclusion part THEN-. If an example of an actual fuzzy rule is indicated below, (1) IF : TP_{+100} temperature =. [Low] AND ΔTP_{+100} temperature = -- under reduction -- THEN:charge-air-temperature = -- AND raised considerably -- quantity [of the blow-off style] = -- (2) IF raised considerably : TP_{+100} temperature = -- low AND ΔTP_{+100} temperature = -- under an increase -- THEN:charge-air-temperature = -- as it is. AND -- quantity [of the blow-off style] = -- (3) IF raised for a while : TP_{+100} temperature = -- high AND ΔTP_{+100} temperature = -- under reduction -- THEN:charge-air-temperature = -- as it is. (4) IF : TP_{+100} temperature =. [High] AND ΔTP_{+100} temperature = -- under an increase -- THEN:charge-air-temperature = -- (5) IF lowered considerably : TP_{+100} temperature = -- just right AND ΔTP_{+100} temperature = -- under reduction -- THEN:charge-air-temperature = -- (6) IF raised for a while : TP_{+100} temperature = -- just right. AND ΔTP_{+100} temperature = -- under an increase -- THEN:charge-air-temperature = -- (7) IF lowered for a while : TP_{+1700} temperature = -- high AND ΔTP_{+1700} temperature = -- under an increase -- quantity [of the THEN:blow-off style] = -- (8) IF raised considerably : TP_{+1700} temperature = -- high. AND ΔTP_{+1700} temperature = -- under reduction -- quantity [of the THEN:blow-off style] = -- (9) IF raised for a while : TP_{+1700} temperature = -- just right AND ΔTP_{+1700} temperature = -- under an increase -- quantity [of the THEN:blow-off style] = -- (10) IF raised for a while : TP_{+100} temperature = -- just right AND TP_{+1700} temperature = -- just right. [AND] ΔTP_{+1700} temperature = -- under reduction -- quantity [of the THEN:blow-off style] = -- (11) IF lowered for a while : TP_{+100} temperature = -- just right AND TP_{+1700} temperature = -- low AND ΔTP_{+1700} temperature = -- under an increase -- quantity [of the THEN:blow-off style] = -- (12) IF lowered for a while : TP_{+100} temperature = -- just right AND TP_{+1700} temperature = -- low AND ΔTP_{+1700} temperature = -- under reduction -- quantity [of the THEN:blow-off style] = -- (13) IF lowered considerably : TP_{+100} temperature = -- high AND TP_{+1700} temperature = -- just right. AND ΔTP_{+1700} temperature = -- under reduction -- quantity [of the THEN:blow-off style] = -- (14) IF lowered for a while : TP_{+100} temperature = -- high AND TP_{+1700} temperature = -- low AND ΔTP_{+1700} temperature = -- under an increase -- quantity [of the THEN:

blow-off style] =. [(15) IF lowered for a while] AND ΔTP_{+100} temperature = -- high AND ΔTP_{+1700} temperature = -- low -- : 1700 temperature = -- under reduction -- quantity [of the THEN:blow-off style] = -- in addition it lowers considerably, ΔTP_{+100} temperature or ΔTP_{+1700} temperature shows a time rate of change in TP_{+100} temperature or TP_{+1700} temperature here, respectively.

[0028] And in the un-fuzzy-ized part 25, the amount of operations is determined by the membership function of the charge air temperature shown in drawing 9 (A), and the amount of operations is determined by the membership function of the quantity of the blow-off style shown in drawing 9 (B).

[0029] Drawing 10 is a figure for explaining the example of the above-mentioned fuzzy control. As a fuzzy rule, it is a rule (a).

IF: TP_{+100} temperature = -- high AND ΔTP_{+100} temperature = -- which is going up -- rule (b) lowered considerably

IF: TP_{+100} temperature = -- high AND ΔTP_{+100} temperature = -- which has fallen -- more as it is, If it is made to input fuzzy reasoning as $TP_{+100}=A$ and $\Delta TP_{+100}=B$,

** Search for the reliability in each input values A and B in each element of conditional part each of a rule, ** Make the minimum (Min) into the reliability of a conditional part among the acquired reliability, ** applying a limiting circuit to the membership function of the Conclusion part by the reliability of a conditional part -- -- -- processing -- -- for every rule -- -- -- acquire the output value C shown in drawing 10 by taking the center of gravity of the logical sum (pile up) of the membership function of each rule Conclusion part obtained by processing of them.

[Brief Description of the Drawings]

[Drawing 1] It is a lineblock diagram showing one embodiment of the temperature controller in the whole surface floor blow-off method air-conditioner of this invention.

[Drawing 2] It is a flow figure in which showing one embodiment of the temperature controller in this invention, and showing the flow of processing.

[Drawing 3] It is a figure showing the temperature distribution curve of the height direction of **.

[Drawing 4] It is a flow figure in which showing other embodiments of the temperature controller in this invention, and showing the flow of processing.

[Drawing 5] It is a flow figure showing the flow of processing following drawing 4.

[Drawing 6] It is a lineblock diagram of a control system showing other embodiments of this invention.

[Drawing 7] The figure in which drawing 7 (A) shows the membership function of the temperature of the habitation region lower part, and drawing 7 (B) are the figures showing the membership function of the rate of change in the temperature of the habitation region lower part.

[Drawing 8] The figure in which drawing 8 (A) shows the membership function of the temperature of the habitation region upper part, and drawing 8 (B) are the figures showing the membership function of the rate of change in the temperature of the habitation region upper part.

[Drawing 9] The figure in which drawing 9 (A) shows the membership function of charge air

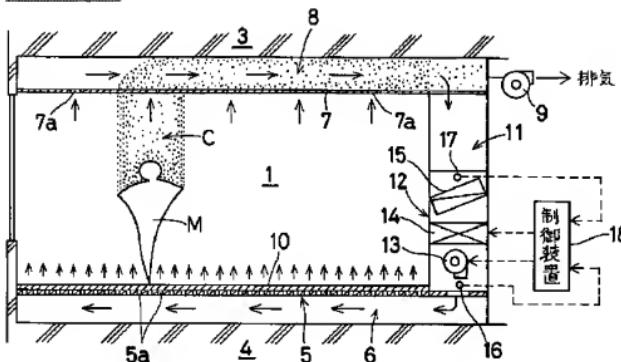
temperature, and drawing 9 (B) are the figures showing the membership function of the quantity of the blow-off style.

[Drawing 10] It is a figure for explaining the example of the fuzzy control in this invention.

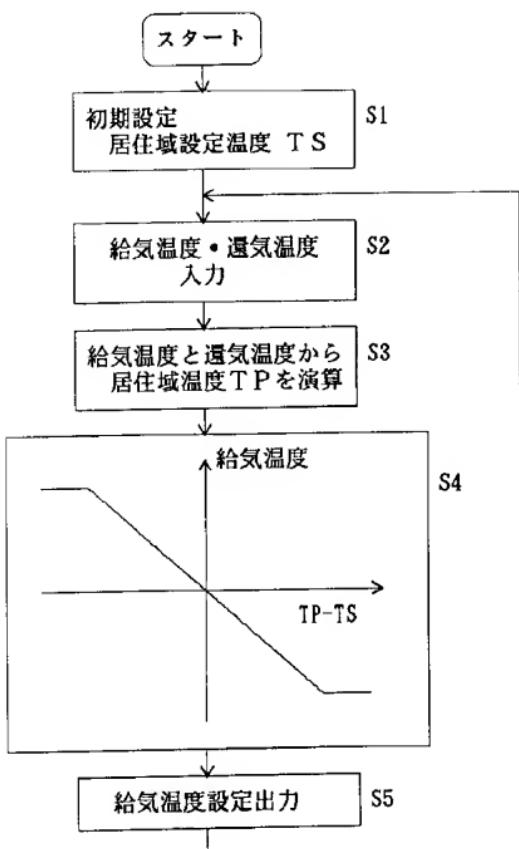
[Explanations of letters or numerals]

1 [-- A blow-off hole, 6 / -- Air supply chamber] -- A room, 3, 4 -- Slab, 5 -- A floor member, 5a
 7 [-- Exhaust air Hwang] -- A ceiling member, 7a -- An exhaust air hole, 8 -- An exhaust air chamber, 9
 10 [-- Fan] -- A carpet, 11 -- A machinery room, 12 -- An air conditioner, 13
 14 -- A heat exchanger, 15 -- A filter, 16 -- Charge-air-temperature sensor
 17 -- A ***** degree sensor, 18 -- Control device

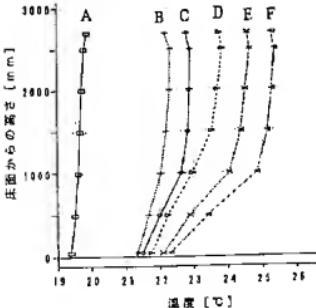
[Drawing 1]



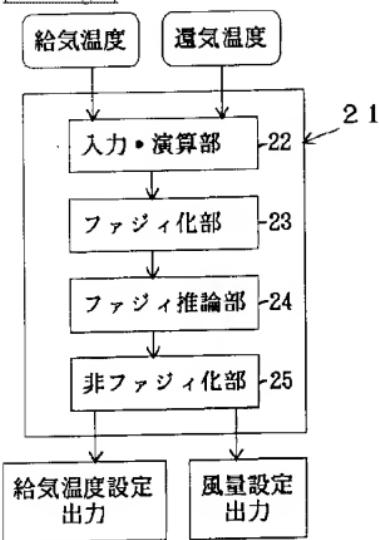
[Drawing 2]



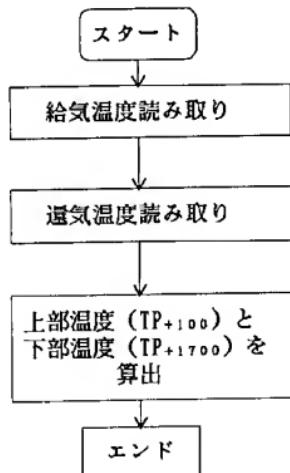
[Drawing 3]



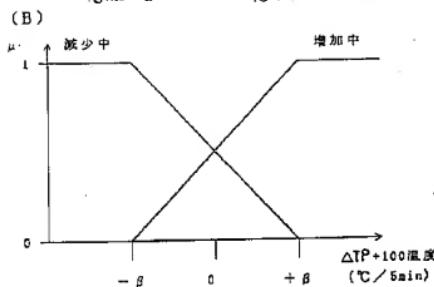
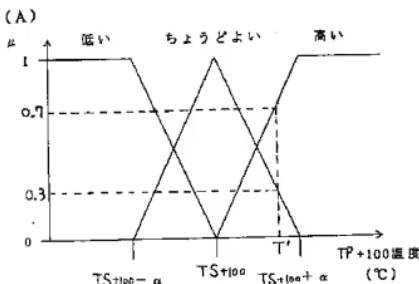
[Drawing 6]



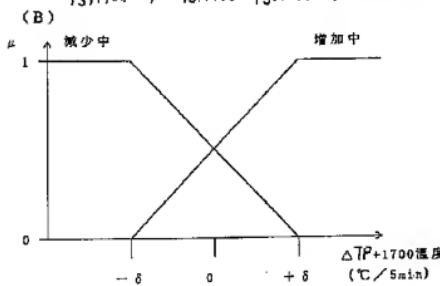
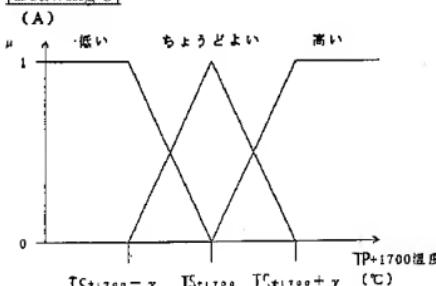
[Drawing 4]



[Drawing 7]

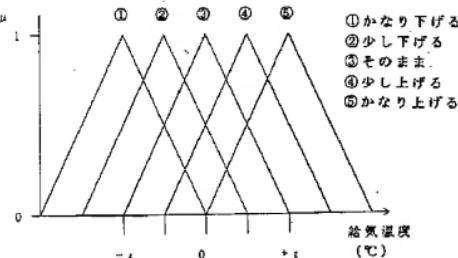


[Drawing 8]

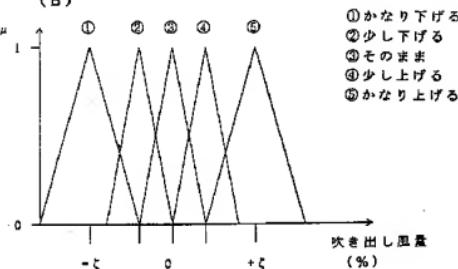


[Drawing 9]

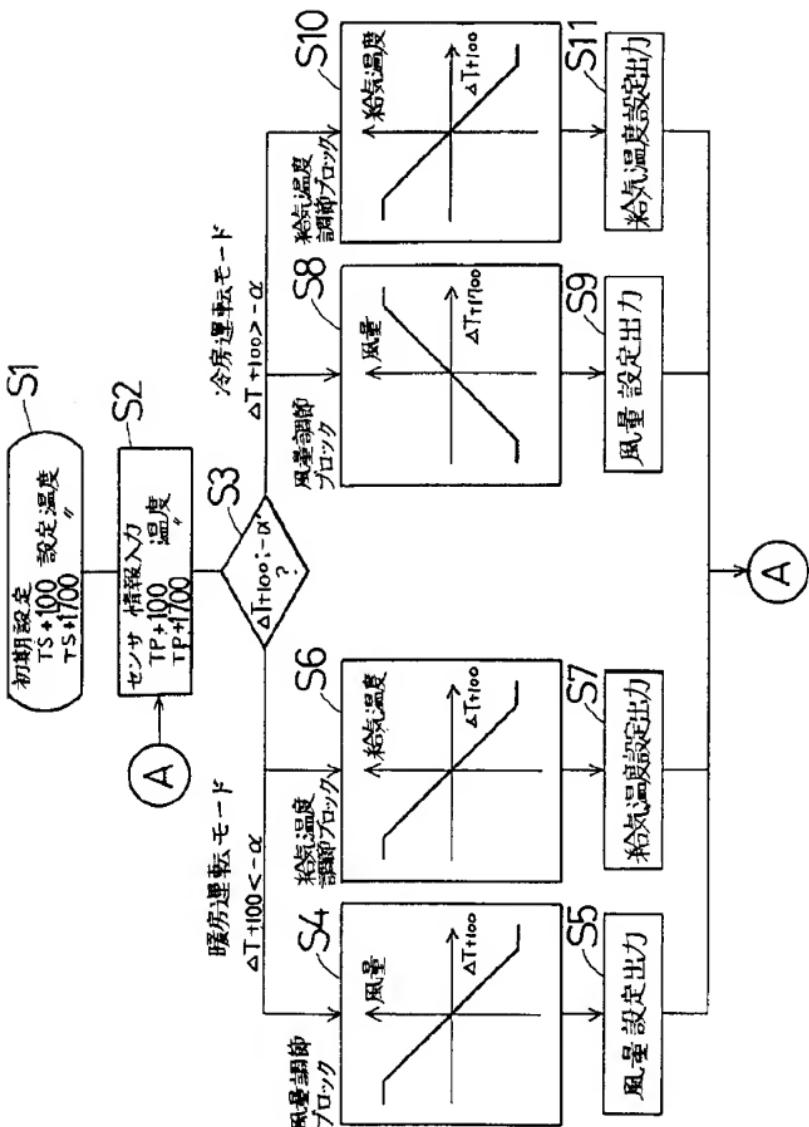
(A)



(B)

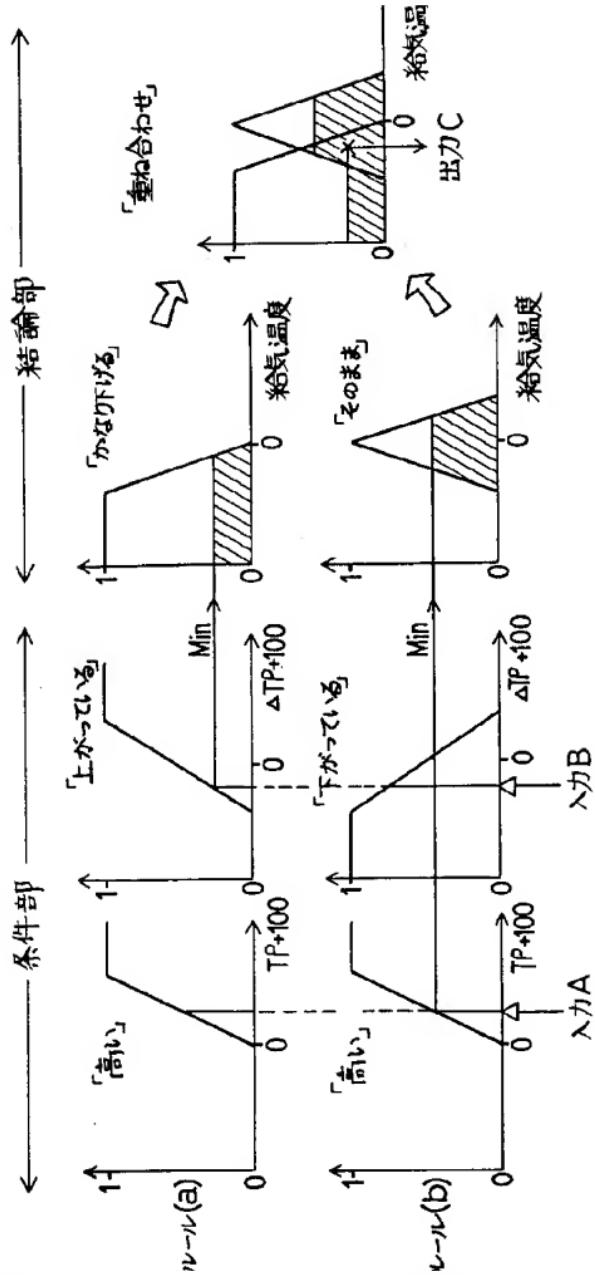


[Drawing 5]



[Drawing 10]

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[Translation done.]